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USSR WORK ON RESUSCITATION BY MEANS OF ARTIFICIAL BLOOD  
CIRCULATION OF ANIMALS DEAD FROM ANOXIA

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There are three main approaches to the revival of a dead organism.

The first consists of restoring the function of the heart. If the heart beat can be restored, then natural respiration and blood circulation can be induced by means of artificial respiration.

The second approach restores blood circulation by means of a mechanical apparatus instead of the natural heart beat and respiration, i.e., by a method of artificial blood circulation.

The third approach, which is the most acceptable method with regard to a possible future practical solution of the problem of reviving an organism, consists of temporarily stopping the tissue respiration of the corpse by the intravenous injection of appropriate preparations or by rapidly cooling the brain. After that, a method of artificial blood circulation can be utilized to revive the dead animal.

A method of artificial blood circulation based on the second principle was used in experiments designed to resuscitate dogs that had been killed by exsanguination.

Many of our experiments were accompanied by studies of the gases present in the blood, of the changes which take place in the momentary volume of blood in the organism being revived, and of the volumetric rate of blood flow in one of the carotid arteries.

First, a brief report on some general results of the experiments will be given. Of the 95 dogs which were in a state of clinical death from 6 minutes 12 seconds to 16 minutes, 20 lived for a long period of time after being revived, and subsequently recovered all the principal functions of their central nervous systems. Fifteen of these 20 dogs were dead 10 minutes or longer before they were revived. A. E. Khilchenko, an associate of the Institute of Physiology of the Academy of Sciences Ukrainian SSR, developed conditioned reflexes in a few of the dogs which had been revived.

It was also successfully proven that dogs which had been dead for as long as one hour could be revived, and that they could live for a short period of time after revival.

Restoration of the functions of the respiratory center was observed in dogs that had been dead between one hour 32 minutes and one hour 45 minutes.

On the basis of the experimental data obtained it can be assumed that the possibilities of revival and restoration of the functions of the cerebral nerve centers are much more extensive than a great many authors suppose.

The author of this article thinks that the final death of the nerve cells apparently takes place not because their oxygen supply is cut off, as has been generally supposed, but mainly because of the accumulation in the brain tissue of the harmful products of cell metabolism which are formed during the course

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of clinical death. These harmful products are formed at the expense of the consumption by the cerebral cells of the oxygen which is still present in the blood vessels at the beginning of clinical death and also at the expense of other biochemical reactions which occur in the brain tissue after blood circulation has stopped.

We have established that during the first few minutes after the beginning of artificial circulation almost all of the blood flows into the blood vessels which run from the descending aortic arch. Soon thereafter, however, there is a considerable increase in the volumetric rate of the flow of blood in the blood vessels of the brain, since, for example, from 13.42% to 36.86% of all blood circulating in the revived organism passes through just one of the carotid arteries. During this period the brain tissues use oxygen quite intensively. This intense use of oxygen by the tissues of the revived organism begins during the first few minutes and lasts for 2 hours after the beginning of artificial circulation.

A sharply pronounced and constantly increasing hypocapnia is noted at the same time. Restoration of the functions of the respiratory center takes place when there is a low carbon dioxide content in the arterial blood, and, despite constantly increasing hypocapnia, respiration gradually improves, becoming approximately normal toward the end of the use of artificial blood circulation.

The claim of many authors (I. P. Petrov, V. A. Negovskiy, and others) that cells of the central nervous system, particularly of the cerebral cortex, cannot survive clinical death lasting more than 5-6 minutes, is erroneous. The error apparently is due to the fact that those authors used an imperfect method of reviving dead animals and human beings.

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